The effect of waist movement on golf putting outcome

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ABSTRACT: Putting is a type of golf stroke that is performed using a club known as a putter. It is performed while golfers are on or near the green. Good putting may affect the outcome of a game by up to 40%. This research looks at a way for providing quantifiable feedback to golfers to help them improve their putting skills. A MbientLab MetaMotionS sensor (MMS) was positioned at three points along a golfer's waist to measure waist movement during putting strokes. The experimental findings show that each location has distinct motions when it comes to creating straight putts. The findings will undoubtedly aid golfers in analyzing and improving their putting performance.

Keywords: *Accelerometer, motion sensor, waist movement, putting performance.*

1. INTRODUCTION

The putting stroke necessitates precision and accuracy in motor control [1]. To prevent the golf ball from being lifted or knocked up, the kinetic energy produced by the backswing must be efficiently transmitted to the golf ball upon impact. At the same time, the putter face, where impact occurs, must be controlled to maintain a square face at impact, or else the ball path will be affected. All of these are closely connected to the bodily action used to generate the putting stroke.

Recent studies on improving putting strokes include mental aspects [2] and visualization [3]. In terms of body movement, researchers are focusing on the general golf swings [4], not on putting strokes. Moreover, most of the putting training kits are also focusing on visualization [5]. On the current practices, golfers are still relying on qualitative results, either the golf ball gets in or misses the hole, rather than quantitative feedback for their putting.

This research looks into the mobility of the upper body components that are involved in producing putting strokes. The focus of this paper has been narrowed down to the waist in particular. The motions, quantified as in an acceleration unit, will provide golfers with numerical feedback to help them analyse their putting strokes.

2. METHODOLOY

The MbientLab MetaMotionS sensor (MMS) was attached to three locations along the waist (Left side, Right side, and Centre) of a mid-handicap golfer. For each location of the MMS sensor, the golfer had performed several putting strokes in which the objective is to place the golf ball in the targeted area. The putting surface is flat, and the targeted area is located between 1.8 m to 2.0 m from the golfer. Markers were placed on the putting surface to identify the straight path from the starting point to the targeted area. During each putting stroke, the MMS sensor will collect the waist's acceleration about three axes as illustrated in Figure 1.

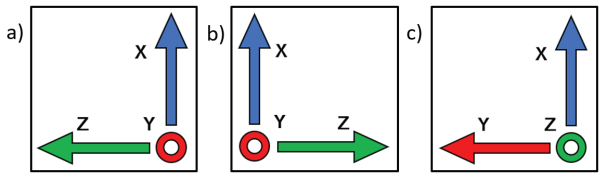

Figure 1. The three axes of the MMS sensor with respect to its location on waist of the golfer; a) Left side, b) Right side, and c) Centre of the waist.

3. RESULTS AND DISCUSSION

The outcomes of the analysis include the acceleration of the waist with respect to the three axes for the three MMS sensor locations, as well as the ball path. The followings are among the significant findings.

2.1 Movement of the Left side of the waist

Acceleration with respect to Y-axis increases negatively during the backswing, as seen in Figure 2. However, only a slight variation occurs on the acceleration value during the execution and follow-through stages. The results suggest that straight putts are more likely if the left side of the waist does not shift around the Y-axis beyond the execution phase.

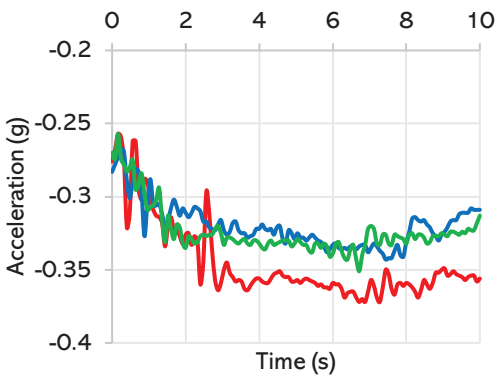

Figure 2. Movement of the left side of the waist with respect to Y-axis for several straight putts.

2.2 *Movement of the Right side of the waist*

When the MMS sensor is mounted to the right side of the waist, the ball will travel out of the straight course if the right side of the waist moves with respect to the Z-axis after the execution or during the follow-through phase. As seen in Figure 3, the acceleration reduces by roughly 0.05g for all samples. The reductions depict the right side of the waist was moving down after hitting the ball.

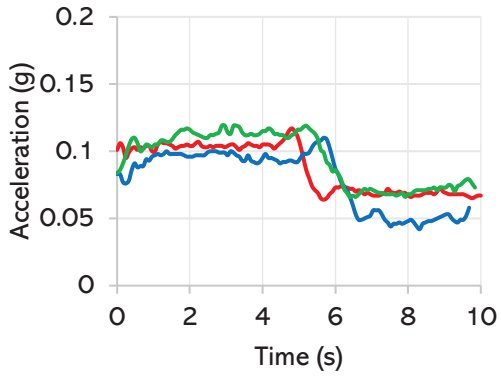

Figure 3. Movement of the right side of the waist with respect to Z-axis for several bend putts.

2.3 *Movement of the Centre of the waist*

Meanwhile, when the MMS sensor was placed at the center of the waist, only the acceleration with respect to Z-axis is significant. As shown in Figure 4, acceleration decreases during backswings and increases throughout the execution period.

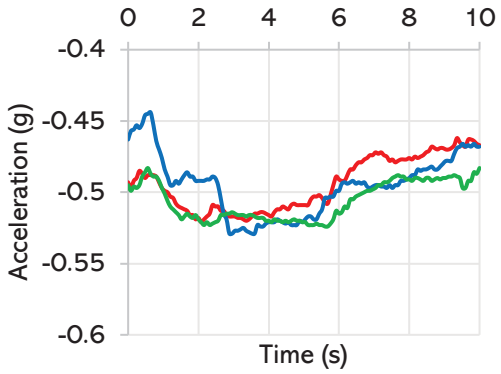

Figure 4. Movement of the center of the waist with respect to Z-axis for several straight putts.

The findings (Figures 2–4) indicate that waist movements influenced the putting outcome, which was either a straight or a bend putt for this study. Golfers are needed to launch the ball in a straight putt most of the time, even on a slope, thus knowing the waist movement is essential [6].

Furthermore, monitoring waist movement in three different locations provides more comprehensive data. For example, Figure 2 suggests that there should be no movement after the execution phase, but Figure 4 shows the contrary observation, demonstrating that the movement of the left side and the center of the waist is different. When the left side is stationary and the center moves, a twisting motion occurs, with the left side of the waist acting as the pivot. According to these observations, this type of twisting action increases the likelihood of a straight putt.

This research also emphasizes the significance of having numerical data to analyze the putting stroke. The common feedback that is either the ball gets in or misses the hole cannot provide details such as how the waist should move to obtain straight putts.

4. CONCLUSION

This study explores ways to provide quantitative feedback for golfers to improve their putting performance. In this paper, the movement of the waist was measured using the MbientLab MetaMotionS sensor (MMS). Experimental results show that the waist movements affected the putting outcome. The numerical data from the MMS sensor helps golfers to analyze their waist motion in generating good putts.

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